

CLAIMS

1. A method for printing a document in a data communications system, the system including a processing unit including a printer client (1001) and a printer including a printer server (1002), the processing unit and the printer using for communication between each other a wireless printer protocol, the Bluetooth protocol stack and air interface, the Bluetooth protocol stack including a wireless printer protocol and a Logical Link Control and Adaptation Protocol (L2CAP), the method including the steps of:

establishing (701) a bi-directional wireless asynchronous connection-less (ACL) connection between the processing unit and the printer by means of the printer protocol calling the L2CAP requesting the connection and the L2CAP creating the connection;

establishing (702) a connection for one or more printjobs between the printer client (1001) and the printer server (1002);

negotiating (703) configuration parameters between the printer client (1001) and the printer server (1002);

sending (704) keep alive messages frequently from the printer client (1001) to the printer server (1002) and from the printer server (1002) to the printer client (1001);

starting (705) a print job;

sending (706) the print data from the processing unit to the printer;

stopping (707) the print job; and

closing (708) the connection between the processing unit and the printer.

2. The method according to claim 1, comprising the further step to be taken before the step of establishing (701) a bi-directional wireless ACL connection:

selecting a printer among a number of available printers.

3. The method according to claim 2, wherein the step of selecting a printer is performed by using the Device Discovery Protocol.

4. The method according to any of the previous claims, comprising the further step to be taken before the step of establishing (701) a bi-directional wireless ACL connection:

5 obtaining an address of a printer.

5. The method according to claim 4, wherein the step of obtaining an address of a printer is performed by using the Device Discovery Protocol.

6. The method according to claim 5, wherein the establishing a connection for one or more printjobs is performed by sending a connection request message (1003) from the printer client (1001) to the printer server (1002).

7. The method according to claim 6, wherein the establishing a connection for one or more printjobs is performed by responding upon the request whether the connection was successful or not, in a response message (1004) sent from the printer server (1002) to the printer client (1001).

8. The method according to any of the previous claims, wherein the step of negotiating configuration parameters (503), between the printer client (1001) and the printer server (1002), is performed by the printer client (1001) requesting configuration in a message (1101) sent to the printer server (1002), the message including no new options, if printer client (1001) uses default values.

9. The method according to any of the previous claims, wherein the step of negotiating configuration parameters (503), between the printer client (1001) and the printer server (1002), is performed by the printer client (1001) requesting configuration in a message (1103) sent to the printer server (1002), the message including a suggestion of configuration options.

10. The method according to claim 9, wherein said configuration request is responded to by the printer server (1002) in a message (1102, 1104, 1106) indicating whether the configuration options in the configuration request are supported by the printer server (1002) or not.

11. The method according to claim 10, including the further step, if the configuration request responds failure; *sending* a further configuration request message (1105, 1109) from the printer client (1001) to the printer server (1002), the message including suggestion of configuration options which differs from earlier suggestions of configuration options..

12. The method according to any of the previous claims, comprising the further step to be taken after the step of negotiating configuration parameters (503): *sending* a set attribute request message (1201) from the printer client (1001) to the printer server (1002) the message comprising a coding table concerning a negotiated coding type.

13. Method according to claim 12, comprising the further step of:
the printer server (1002) *loading* the coding table by means of said received set attribute request message (1201).

14. Method according to claim 13, comprising the further step of:

sending a response whether the loading of the coding table was successful or not in a message (1202) from the printer server (1002) to the printer client (1001).

15. The method according to any of the previous claims, wherein a keep alive timer is implemented in the printer client (1001) and in the printer server (1002), comprising the further step of :

starting the keep alive timer each time a valid message is received from the remote endpoint.

16. The method according to claim 15, wherein said keep alive timer expires, comprising the further step of:
closing the connection.

17. The method according to any of the previous claims, wherein the step of starting a print job (505) is performed by the printer client (1001) requests the printer server (1002) to start a printjob in a request message (1305).

18. The method according to claim 17, wherein said start printjob request message (1305) is received and confirmed by the printer server (1002), the confirmation sent in message (1306) to the printer client (1001).

19. The method according to any of the previous claims, wherein the step of sending the print data from the processing unit to the printer (506), is performed by requesting the printer server (1002) to print data sent in a number of messages (1307, 1308, 1310).

20. The method according to claim 19, comprising the further step to be taken after the printer server (1002) have

received a previous decided number of print data request messages:

5 *sending* an acknowledgement message (1309) from the printer server (1002) to the printer client (1001).

21. The method according to any of the previous claims, comprising the further step to be taken if the printer runs out of paper:

5 *indicating* that the printer is out of paper in a message (1406) sent from the printer server (1002) to the printer client (1001).

22. The method according to claim 21, comprising the further step to be taken when the printer is refilled:

5 *indicating* that the printer is refilled in a message (1407) sent from the printer server (1002) to the printer client (1001).

23. The method according to claim 22, comprising the further step to be taken after the printer client (1001) has received an indication message (1407) that the printer is refilled:

5 *continuing* the printing process by continuing to send print data request messages, (1408, 1409) starting with the print data subsequent to the last received print data acknowledgement message (1405).

24. The method according to any of the claims, wherein the ACL connection is disconnected during printing, the method comprising the further step of:
 stopping the keep alive timer.

25. The method according to claim 24, wherein a new ACL connection is created comprising the further step of:

requesting a reconnection of the session defined by the session identifier in a message (1506) sent from the printer client (1001) to the printer server (1002).

26. The method according to claim 25, comprising the further step of:

sending a response according to whether the reconnection is granted or not in a message (1507) from the printer server (1002) to the printer client (1001).

27. The method according to claim 26, comprising the further step to be taken after the printer client (1001) has received a granted reconnection response:

continuing the printing process by continuing to send print data request messages (1508, 1509), starting with the print data subsequent to the last received print data acknowledgement message (1505).

28. The method according to any of the previous claims, wherein the step of stopping the print job (707), is performed by, after sending all data to be printed to the printer server (1002), sending a request to stop the printjob in a message (1311) from the printer client (1001) to the printer server (1002).

29. The method according to claim 28, comprising the further step to be taken after the printer server (1002) has received a request to stop the printjob;

sending a response message (1312), comprising a confirmation that this is apprehended, from the printer server (1002) to the printer client (1001).

30. The method according to any of the previous claims, wherein the step of closing the connection between the processing unit and the printer (708) is performed by the printer client (1001) requesting a disconnection of the

5 session defined by the session identity in a message (1313)
sent to the printer server (1002).

31. The method according to claim 30, wherein the printer
server responses to whether the disconnection was granted
or not, in a response message (1314) sent from the printer
server (1002) to the printer client (1001).

32. The method according to any of the previous claims,
comprising the further step to be taken after the step of
closing the connection between the processing unit and the
printer (708):

5 *stopping* the sending of keep alive messages.

33. A computer program product directly loadable into the
internal memory of a digital computer within a processing
unit or printer in a communication system, comprising the
software code portions for performing the steps of any of
5 the claims 1-32, when said product is run on a computer.

34. A computer program product stored on a computer usable
medium, comprising readable program for causing a computer
within a processing unit or printer in a communication
system, to control an execution of the steps of any of the
5 claims 1-32.

35. An entity (501) included in a Processing unit (402), the
entity includes a Bluetooth protocol stack comprising a
Logical Link Control and Adaptation Protocol (L2CAP)
characterised in that the Bluetooth protocol stack further
5 comprises a wireless printer protocol, said printer
protocol comprising a printer client which communicates
(803) with a printer server, included in a printer (403),
by means of the Bluetooth protocol stack and air interface,
the entity (501) further comprises:

- 10 an establishing device (502) arranged for establishing a
bi-directional wireless ACL connection to the printer
(403) by calling the L2CAP requesting the connection;
an establishing device (503) arranged for establishing a
connection for one or more printjobs
- 15 a negotiating device (504) arranged for negotiating
configuration parameters with a printer server within the
printer(403);
a sending device (509) arranged for sending keep alive
messages frequently to the printer server ;
- 20 a starting device (513) arranged for starting a print job;
a sending device (515) arranged for sending the print data
to the printer server;
a stopping device (520) arranged for stopping the print
job; and
- 25 a closing device (522) arranged for closing the connection
between the processing unit (402) and the printer (403).
36. The entity (501) according to claim 35, **characterised** by
comprising a sending device arranged for sending a
connection request message from the printer client to the
printer server.
37. The entity (501) according to any of the claims 35-36
wherein when negotiating configuration parameters, the
printer client uses default values, **characterised** by
comprising a sending device (505) arranged for sending a
configuration request message to the printer server, the
5 message including no new options.
38. The entity (501) according to any of the claims 35-37,
characterised by comprising a sending device (506) arranged
for sending a configuration request message to the printer
server, the message including a suggestion of configuration
5 options.

39. The entity (501) according to any of the claims 35-38, **characterised** by comprising a sending device (507) arranged for sending a further configuration request to the printer server, the message including suggestion of configuration options which differs from earlier suggestions of configuration options.

40. The entity (501) according to any of the claims 35-39, **characterised** by comprising a sending device (508) arranged for sending a set attribute request message to the printer server, the message comprising a coding table concerning a negotiated coding type.

41. The entity (501) according to any of the claims 35-40, **characterised** in that a keep alive timer (510) is implemented in the printer client.

42. The entity (501) according to claim 41, **characterised** by comprising a starting device (511) arranged for starting the keep alive timer (510) each time a valid message is received from the printer (403).

43. The entity (501) according to claim 42, **characterised** by comprising a closing device (512) arranged for closing the connection between the printer client and the printer server, when the keep alive timer(510) expires.

44. The entity (501) according to any of the claims 35-43, **characterised** by comprising a sending device (514) arranged for sending a request message to the printer server comprising a request to start a printjob.

45. The entity (501) according to any of the claims 35-44, **characterised** by comprising a sending device (516) arranged

for sending a number of request messages to the printer server, the messages comprising print data.

46. The entity (501) according to any of the claims 35-45, wherein a refill of paper has broken a printing process, **characterised** by comprising a continuing device (517) arranged for continuing the printing process by continuing to send print data request messages to the printer server, starting with the print data subsequent to the last received print data acknowledgement message.

47. The entity (501) according to claim 41, **characterised** by comprising a stopping device (518) arranged for stopping the keep alive timer when the ACL connection is disconnected during a printing process.

48. The entity (501) according to any of the claims 35-47, wherein a new ACL connection is created to the printer after a break, **characterised** by comprising a requesting device (519) arranged for requesting a reconnection of a session defined by the session identifier in a message sent to the printer server.

49. The entity (501) according to claim 48, wherein a granted reconnection response message is received, **characterised** by comprising a continuing device (517) arranged for continuing the printing process by continuing to send print data request messages to the printer server, starting with the print data subsequent to the last received print data acknowledgement message.

50. The entity (501) according to any of the claims 35-49, wherein all data to be printed is sent to the printer **characterised** by comprising a sending device (521) arranged for sending a message to the printer server, the message comprising a request to stop the printjob.

51. The entity (501) according to any of the claims 35-50,
characterised by comprising a sending device (523) arranged
for sending a message to the printer server, the message
comprising a request to disconnect a session identified by
a session identity.

52. The entity (501) according to any of the claims 35-51,
characterised by comprising a stopping device (524)
arranged for stopping the sending of keep alive messages
after closing a connection between the printer client and
the printer server.

53. A printer entity (601) included in a Printer (403), the
printer entity (601) including a Bluetooth protocol stack
comprising a Logical Link Control and Adaptation Protocol
(L2CAP) **characterised** in that the Bluetooth protocol stack
further includes a wireless printer protocol, said printer
protocol comprising a printer server which communicates
with a printer client, included in a processing unit (402),
by means of the wireless printer protocol, the Bluetooth
protocol stack and air interface, the printer entity (601)
further comprises:

a negotiating device (605) arranged for negotiating
configuration parameters with a printer client within the
processing unit;

a sending device (609) arranged for sending keep alive
messages frequently to the printer client ;

a starting device (612) arranged for starting a print job;

a receiving device (614) arranged for receiving print data
from the printer client; and

a stopping device (620) arranged for stopping the print
job.

54. The printer entity (601) according to claim 53
characterised in comprising a responding device (604)

arranged for responding upon a connection request whether the connection is successful or not, in a response message sent to the printer client.

55. The printer entity (601) according to any of the claims 53-54 **characterised** in comprising a responding device (606) arranged for responding upon a configuration request whether the configuration options in the configuration request are supported by the printer server or not.

56. The printer entity (601) according to any of the claims 53-55 **characterised** in comprising a loading device (607) arranged for loading a coding table sent from the printer client.

57. The printer entity (601) according claim 56 **characterised** in comprising a sending device (608) arranged for sending a response whether the loading of the coding table was successful or not to the printer client.

58. The printer entity (601) according to any of the claims 53-57, **characterised** in that a keep alive timer (610) is implemented in the printer server.

59. The printer entity (601) according to claim 58, **characterised** by comprising a starting device (611) arranged for starting the keep alive timer each time a valid message is received from the printer.

60. The printer entity (601) according to any of the claims 53-59, **characterised** in comprising a confirming device (613) arranged for confirming a start printjob request message sent to the printer client.

61. The printer entity (601) according to any of the claims 53-60, **characterised** in comprising a sending device (615) arranged for sending an acknowledgement message to the printer client after receiving a previous decided number of print data request messages.

62. The printer entity (601) according to any of the claims 53-61, **characterised** in comprising an indicating device (616) arranged for indicating, in a message sent to the printer client, that the printer is out of paper, if the printer ~~runs~~ out of paper.

63. The printer entity (601) according to any of the claims 53-62, **characterised** in comprising an indicating device (617) arranged for indicating, in a message sent to the printer client, that the printer is refilled, when the printer is refilled.

64. The printer entity (601) according to any of the claims 53-63, **characterised** by comprising a stopping device (618) arranged for stopping the keep alive timer when an ACL connection to the processing unit is disconnected during a printing process.

65. The printer entity (601) according to any of the claims 53-64, **characterised** in comprising a sending device (619) arranged for sending a response message to the printer client, according to whether a reconnection request is granted or not.

66. The printer entity (601) according to any of the claims 53-65, **characterised** in comprising a sending device (621) arranged for sending a response message, after the printer server has received a request to stop the printjob, the

5 message comprising a confirmation that this is apprehended
and is sent to the printer client.

67. The printer entity (601) according to any of the claims
53-66, **characterised** in comprising a sending device (622)
arranged for sending a response message to the printer
client, according to whether a disconnection request is
5 granted or not..

68. The printer entity (601) according to any of the claims
53-67, **characterised** in comprising a stopping device (623)
arranged for stopping the sending of keep alive messages
after the connection to the printer client is closed.

69. Communications system (401) **characterised** by comprising
a processing unit (501) according to any of the claims 35-
52 and a printer entity (601) according to any of the
claims 53-68.

09867429-053101